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TITLE: Hydraulic **parking brake** system, particularly for **rail** vehicles - supplies fluid both for unlocking and actuating brake mechanism

PATENT-ASSIGNEE: INVENTIO AG[INVN]

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BASIC-ABSTRACT:

Braking is effected by one or more hydraulic cylinders having mechanical locks which can be released by hydraulic fluid at a lower pressure than that required for braking. A **pump** is manually or otherwise operated to generate the braking pressure, and the lower pressure is derived from the braking pressure by a proportioning device such as a differential-area piston unit. This ensures that braking pressure is available before unlocking, and after a brake application re-locking occurs. To release the brakes, the **pump** may be operated in reverse to draw the brake fluid from the cylinders while holding them unlocked.

TITLE-TERMS: HYDRAULIC PARK BRAKE SYSTEM **RAIL** VEHICLE SUPPLY FLUID UNLOCK ACTUATE BRAKE MECHANISM

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(54) HYDRAULIC PARKING BRAKE SYSTEM

(71) We, INVENTIO AKTIENGESELLSCHAFT, of 6052 Hergiswil NW, Switzerland, a joint stock company organised under the laws of Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a hydraulic parking brake system, particularly for rail vehicles.

In rail vehicle construction, hydraulically actuated parking brakes are employed ever more frequently, since actuation of the brakes through a mechanical linkage is in many cases very difficult due to the crowded mode of construction, particularly of the driving bogies. In the case of resiliently suspended carriage frames, the mechanical transmission of force between carriage frame and bogie can become very complicated. A mechanical linkage may also be a source of undesired noise. These disadvantages may be avoided with hydraulic transmission for the application of braking force.

In the construction of a handbrake, which serves as a parking brake, it is above all to be watched, that the braking effect remains maintained for an unlimited time. In the simplest manner, this can be achieved with a conventional self-locking spindle, which actuates the brake shoes and to which is imparted rotary motion by an oil pump and an oil motor. This arrangement however often proves to be difficult to realise or impractical and one must resort to a piston-operated brake incorporating at least one brake sylinder. Since, however, a pressure drop in the hydraulic system due to small leaks is practically impossible to avoid, the brake cylinder must be equipped with a special mechanical locking device, which fixes the piston in its braking position.

In one known hydraulic handbrake system with mechanical locking of the brake piston in the braking pisition, according to Swiss patent no. 483,578, the force transmission to the brake cylinder ensues from at least two operating positions. The system consists of a hand pump, connected with a pressure means container and actuatable by means of a hand crank, which is connected through a non-return valve to a braking cylinder, and of an unlocking cylinder, which is connected to the mechanical locking device of the brake cylinder and controls a cock inserted in a return duct bridging over the hand pump. The unlocking cylinder is in this case actuated by means of a pedal on release of the handbrake.

Different constructions of mechanically locked braking cylinders are known. One construction according to Swiss patent no. 405,396 consists of a piston cylinder arrangement and a housing, which concentrically surrounds the cylinder and is in connection with the piston through a piston rod. Between the cylinder and the housing, there is an annular gap, which has built into it a locking ring, which is sub-divided sectorially into individual parts retained together by a spring and provided with an internal thread of saw tooth profile. The individual parts of the locking ring are out of their helical sequence, so that their thread no longer displays a continuous advance. The cylinder is externally likewise provided with a saw tooth thread in the region of the annular gap. On actuation of the brake cylinder, brake fluid is pumped into the cylinder and the piston rod is thereby urged out from the cylinder. In this, the locking ring is entrained by the housing through a guide ring and slides over the external thread of the cylinder. Due to the saw tooth profile of the thread, the locking ring cannot slide back and effects a locking in the brake position.

Should the locking be released, then braking fluid is urged into a part of the annular gap and through a bushing presses conical bolts between the individual locking ring parts and thereby lifts these off from the thread part of the cylinder. Pulled back by spring force, the piston assumes its rest position.

One disadvantage of such handbrake systems with locking of the piston in the braking position results from the complicated manipulation of the actuating members

[Price 33p]

to release the brake. In order that the mechanical locking device can be released, it must previously be relieved of pressure applied by the piston. This is achieved by the hand pump being once again actuated to apply the brake, whereby the fallen pressure in the brake cylinder is again restored. The release of the mechanical locking device ensues thereafter by a special actuating member. This relatively complicated actuation of a hydraulic locking brake deviates substantially from the actuation of an ordinary mechanical handbrake, so that operating errors are more likely to arise, which in some circumstances may lead to damage of the locking device.

According to the present invention, there is provided a hydraulic parking brake system, comprising at least one selectably operable pump to draw brake fluid from a source of brake fluid through a first non-return valve and to feed that brake fluid through a second non-return valve to at least one brake cylinder provided with mechanical brake-locking means releasable by the application of brake fluid thereto, and a pressure control device having a high pressure section and a low pressure section hydraulically coupled respectively to a working space of the or each brake cylinder and to the locking means, the arrangement being such that operation of the pump to release the brake or brakes coupled to the or each respective brake cylinder causes first the application of brake fluid pressure in the or each working space and then application of brake fluid pressure to the locking means of the or each cylinder.

By a preferred embodiment of the present invention, there is provided a hydraulic handbrake system for rail vehicles, comprising at least one manually operable pump to convey the brake fluid from a brake fluid container through a filter and a non-return valve, and at least one brake cylinder equipped with an indiivdual mechanical locking device and connected with the pump through a non-return valve, wherein a high pressure chamber of a pressure control device connected with a working space of the or each brake cylinder and a low pressure chamber of the pressure control device is connected with a working space of the or each locking device, wherein the pressure control device comprises a differential control piston acted upon by the brake fluid, which on operation of the pump to release the brake or brakes coupled to the or each respective brake cylinder causes the pressure in the working space of the or each brake cylinder to be built up and controls the brake fluid in the working space of the or each locking device.

Two embodiments of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:—

Fig. 1 illustrates a hydraulic handbrake system embodying the invention, and

Fig. 2 a further embodiment with two operating positions.

In Fig. 1, a hand pump 1 is provided with a hand crank 1.1 and has a pump connection 1.2 connected through a non-return valve 2 and a filter 3 to a brake fluid containtr 4. A pump connection 1.3 of the hand pump 1 is connected through a non-return valve 5 and the filter 3 likewise to the brake fluid container 4. The hand pump 1 is connected through the pump connection 1.3 and a non-return valve 6 with working spaces 7.1 and 8.1 of two brake cylinders 7 and 8, in each of which slides a brake piston 7.3 or 8.3, respectively. A high pressure chamber 9.1 of a pressure control device 9, in which is slidably engaged a double-acting, pressure-differential control piston 9.3, is also connected with the working spaces 7.1 and 8.1 of the brake cylinders 7 and 8, while a low pressure chamber 9.2 of the device 9 is connected to the hand pump via the pump connection 1.2 and, via a duct 10, with two working spaces 7.21 and 8.21 of two mechanical locking devices 7.2 and 8.2, which are of the kind described in the specification of Swiss Patent No. 405,396 and which are incorporated in the brake cylinders 7 and 8, the locking devices being releasable by the application of brake fluid. A return duct 11 connects the low pressure chamber 9.2 of the device 9 to the filter 3 and the brake fluid container 4, the container and filter also being connected to an excess pressure valve 12, at the outlet of the valve. The inlet of the excess pressure valve 12 is connected via a non-return valve 13 with the low pressure chamber 9.2 and via a non-return valve 14 with the high pressure chamber 9.1. A return duct 16 is connected via a controllable twin non-return valve 15 with the working spaces 7.1 and 8.1 of the braking cylinders 7 and 8 and with the filter 3 and the container 4. In addition, the twin non-retur valve 15 is connected through a control duct 17 with the low pressure chamber 9.2 of the device 9. The piston 9.3 comprises in the chamber 9.2 a portion which is provided with an annular recess, the portion being slidable in the chamber to connect the ducts 10 and 17 with the duct 11 via the annular recess, or the duct 10, or the ducts 10 and 17 together, with the pump connection 1.2. Flexible, hydraulic connections 18 extend between carriage frame, bogie and brake cylinders 7 and 8, respectively.

During application of the brake, the hand pump 1 is actuated by rotation of the hand crank 1.1 in one direction and brake fluid is drawn from the brake fluid container 4 through the filter 3, the non-return valve 2

and the pump connection 1.2. The brake fluid is conveyed through the pump connection 1.3 via the non-return valve 6 into the working spaces 7.1 and 8.1 of the brake cylinders 7 and 8 and the required brake pressure is built up. In the course of this, the brake pistons 7.3 and 8.3 are displaced into the braking position and retained in this position by means of the locking devices 7.2 and 8.2. Simultaneously, the high pressure chamber 9.1 of the pressure control device 9 is pressurised by the brake fluid and the differential control piston 9.3 is displaced to the right (as shown in Fig. 1). Thereby, the ducts 10 and 17 are connected via the annular recess of the piston with the return duct 11, which is connected through the filter 3 with the brake fluid container 4, and flow of the brake fluid out of the working spaces 7.21 and 8.21 of the locking devices 7.2 and 8.2 is made possible. Flowing back of the brake fluid after completion of the brake process is prevented by the non-return valve 6, whilst the excess pressure valve 12 protects the handbrake system against impermissibly high pressure.

To release the brake, the hand pump 1 is actuated by means of the hand crank 1.1, which is rotated oppositely to the direction of rotation for application of the brake, and brake fluid is drawn from the brake fluid container 4 through the filter 3, the non-return valve 5 and the pump connection 1.3. Through the pump connection 1.2, the brake fluid is pumped into the low pressure chamber 9.2 of the pressure control device 9, so that the differential control piston 9.3 is displaced to the left. Thereby, the pressure in the high pressure chamber 9.1 of the device 9, and thus also in the working spaces 7.1 and 8.1 of the brake cylinders 7 and 8, is increased so that the locking devices 7.2 and 8.2 are relieved of any pressure applied by the pistons 7.3 and 8.3. The differential control piston 9.3 is then further displaced to connect the duct 10 with the pump connection 1.2, so that the brake fluid can flow into the working spaces 7.21 and 8.21 of the locking devices 7.2 and 8.2 and build up the requisite pressure for releasing the locking devices. Thereafter, the differential control piston 9.3 connects the control duct 17 with the pump connection 1.2, so that the brake fluid pumped by the pump acts upon the controllable twin non-return valve 15 to open the return duct 16, to allow the brake fluid to flow back into the brake fluid container 4 from the working spaces 7.1 and 8.1 of the brake cylinders 7 and 8. The return of the brake pistons 7.3 and 8.3 is effected in conventional manner by means of restoring springs (not shown).

In Fig. 2, the hand pump 1 of a first operating control is connected through a twin non-return valve 19, and a hand pump 20 of a second operating control is connected through a twin non-return valve 21, to the brake fluid circuit at the same locations as in the handbrake system according to Fig. 1. The remaining components are similarly arranged and designated as for the handbrake system according to Fig. 1.

On actuation of the hand pump 1 by means of the hand crank 1.1, the twin non-return valve 21 blocks the feed of brake fluid to the hand pump 20, whilst the twin non-return valve 19 on actuation of the hand pump 20 by means of the hand crank 20.1 blocks the feed of brake fluid to the hand pump 1.

It is of course possible to provide more than two operating controls by the already described technique, while similarly only one brake cylinder, or more than two brake cylinders, may be provided.

WHAT WE CLAIM IS:—

1. A hydraulic parking brake system, comprising at least one selectably operable pump to draw brake fluid from a source of brake fluid through a first non-return valve and to feed that brake fluid through a second non-return valve to at least one brake cylinder provided with mechanical brake-locking means releasable by the application of brake fluid thereto, and a pressure control device having a high pressure section and a low pressure section hydraulically coupled respectively to a working space of the or each brake cylinder and to the locking means, the arrangement being such that operation of the pump to release the brake or brakes coupled to the or each respective brake cylinder causes first the application of brake fluid pressure in the or each working space and then application of brake fluid pressure to the locking means of the or each cylinder.

2. A hydraulic handbrake system for rail vehicles, comprising at least one manually operable pump to convey the brake fluid from a brake fluid container through a filter and a non-return valve, and at least one brake cylinder equipped with an individual mechanical locking device and connected with the pump through a non-return valve, wherein a high pressure chamber of a pressure control device is connected with a working space of the or each brake cylinder and a low pressure chamber of the pressure control device is connected with a working space of the or each locking device, wherein the pressure control device comprises a differential control piston acted upon by the brake fluid, which on operation of the pump to release the brake or brakes coupled to the or each respective brake cylinder causes the pressure in the working space of the or each brake cylinder to be built up and controls the brake fluid in the

working space of the or each locking device.

3. A hydraulic brake system substantially as hereinbefore described with reference to and as illustrated in either Fig. 1 or Fig. 2 of the accompanying drawings.

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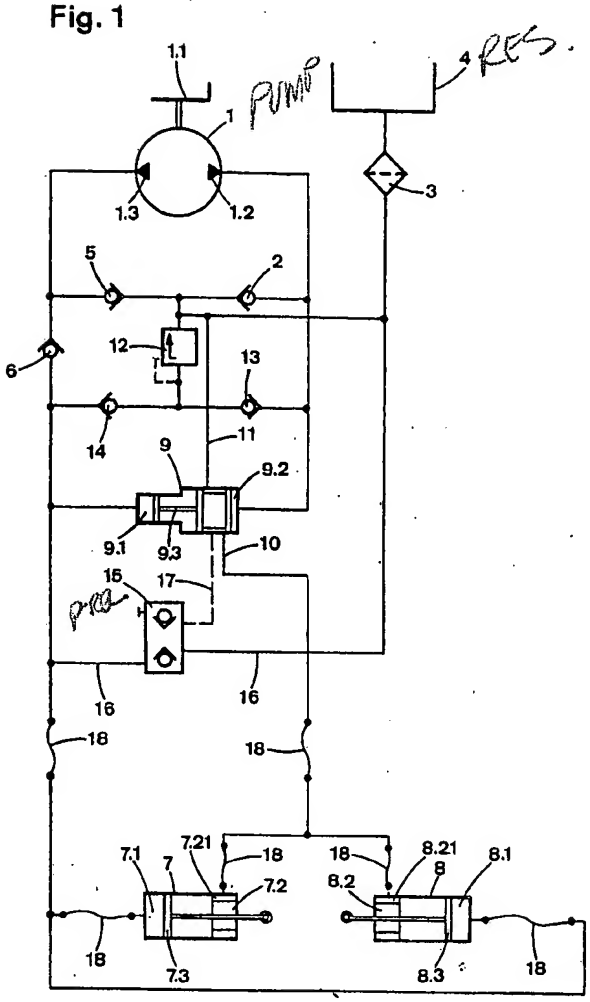
Sheet 1

Fig. 1



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Sheet 2

Fig. 2